

REMARKS

This is a Response to the Office Action mailed October 5, 2009, in which a three (3) month Shortened Statutory Period for Response has been set, due to expire January 5, 2010. Fifty-seven (57) claims, including eight (8) independent claims, were paid for in the application. Claims 66, 67, 69 and 72 are canceled by way of this Response, and claims 10, 11, 16, 31, 32, 34-37, 40, 41, 43-48 and 56 were previously canceled. Claims 1, 9, 12-14, 26-28, 38, 49, 57, 58, 60-65, 68, 70 and 71 have been amended. Claims 74-79 have been added. No new matter has been added to the application. Claims 1-9, 12-15, 17-30, 33, 38, 39, 42, 49-55, 57-65, 68, 70, 71 and 73-79 are pending. The Director is authorized to charge any additional fees due by way of this Amendment, or credit any overpayment, to our Deposit Account No. 19-1090.

Examiner Interview

Applicants thank Examiner Beck for conducting a telephonic interview with Applicants' representative, Mr. Eric M. Ringer, on December 23, 2009.

During the interview, fundamental differences between the cited references and claim limitations were discussed. In particular, the Massie reference and the Guy reference were discussed in relation to calculating tensions of cables and optimizing functions. Examiner Beck indicated that he had not interpreted the words "function" and "optimize" in a mathematical manner. In addition, the meanings of recited claim limitations such as function, optimize, balance, difference, sum and other claim limitations were discussed. While specific claim language for amendments to the rejected independent claims was not discussed, Examiner Beck and Mr. Ringer discussed amending claims to clarify the mathematical nature of certain limitations. Examiner Beck indicated such amendments may help to distinguish claim limitations from the cited references.

Applicants further thank Examiner Beck for clarifying the rejection of claims 70-73. In particular, Examiner Beck indicated that the rejection of claims 70-73 at pages 7 and 8 of the Office Action mailed October 5, 2009, was a mistake and that claims 70-73 stand rejected for the reasons recited at pages 17 and 18 of the Office Action mailed October 5, 2009.

Allowed Claims

Applicants thank Examiner Beck for allowing claims 18-25, 29, 30 and 33.

Objected to Claims

Examiner Beck indicated in the Office Action mailed October 5, 2009, that claims 4, 55 and 66 are objected to and would be allowable if rewritten in independent form to include all of the limitations of their respective base claims and any intervening claims.

At this time, Applicants have decided not to amend claims 4, 55 and 66 in the manner suggested by the Examiner. However, claim 66 formerly depended directly from claim 1, and Applicants have amended claim 1 to recite the limitations of claim 66 and canceled claim 66. Applicants respectfully submit that claim 1 is now in condition for allowance.

Claims Rejected Under 35 U.S.C. §103(a)

Claims 1-9, 12-15, 17, 26-28, 36-39, 42, 49-55 and 57-73 stand rejected under 35 U.S.C. §103(a) as being unpatentable over Sato et al. (U.S. Patent 5,305,429, hereafter Sato) in view of one or more references. In particular, claims 3, 38, 49, 51, 60-65 and 69 stand rejected as being unpatentable over Sato in view of Guy et al. (U.S. Patent 6,879,315, hereafter Guy); claim 50 stands rejected as being unpatentable over Sato in view of Guy and Matsumoto (U.S. Patent 6,587,749); claims 12, 13, 17, 39, 42, 52, 54, and 59 stand rejected as being unpatentable over Sato in view of Guy and Stork et al. (U.S. Patent 6,104,380, hereafter Stork); claim 53 stands rejected as being unpatentable over Sato in view of Guy, Stork, and Matsumoto; claims 1-3, 57, 58 and 70-73 stand rejected as being unpatentable over Sato in view of Guy and Massie et al. (U.S. Patent 5,587,937, hereafter Massie); and claims 5-8 14, 15, 26-28, 67, and 68 stand rejected as being unpatentable over Sato in view of Guy, Massie, and Stork.

Cited References Do Not Teach or Suggest Amended Independent Claims

Applicants have amended independent claims 1, 9, 12, 38, 62 and 70 to recite aspects not disclosed, taught, suggested, or otherwise rendered obvious by any of the relied-upon

references. Thus, Applicants respectfully submit that the pending claims as currently amended are clearly allowable over the relied-upon references.

1. Amended Claim 1

As described above, claim 1 has been amended to incorporate limitations of “objected to” claim 66, which has been canceled. For at least the reason that amended claim 1 recites the subject matter that the Examiner indicated as being allowable, Applicants respectfully submit that claim 1 is in condition for allowance.

Claims 2-8, 57 and 58 depend, directly or indirectly, from claim 1, and consequently, are allowable for at least the reason that they depend from an allowable claim.

2. Amended Claim 12

Claim 12 has been amended to incorporate limitations that clarify distinctions between claimed subject matter and the cited references. In particular, claim 12 has been amended to recite aspects similar to aspects of previously presented claims 14, 67 and 68, which were rejected based on a combination of Sato, Guy, Stork and Massie. However, as is discussed in detail below, Applicants’ amended claim 12 recites aspects not disclosed, taught, suggested, or otherwise rendered obvious by any of the relied-upon references. Thus, Applicants respectfully submit that claim 12, as currently amended, and its dependent claims, claims 13-15, 17, 26-28, 42, 53, 54 and 68, are clearly allowable over the relied-upon references.

Amended claim 12 recites, in part, “a processor system ... being configured to calculate tension vectors corresponding to active tensions applied to the respective cables based at least on a mathematical optimization of a mathematical equation having at least a first term and a second term, the first term including a net vector having a calculated force vector and the calculated tension vectors as components thereof, and the second term including a function having a respective magnitude of each of the calculated tension vectors as arguments thereof, wherein the mathematically optimized equation is close to or equal to zero, and wherein the active tensions applied to the respective cables yield an actual force vector applied to the user interface tool that corresponds to the calculated force vector.” (Emphasis added.)

In accordance with claim 12, a processor system is configured to calculate tension vectors corresponding to active tensions applied to the respective cables based at least on a mathematical optimization of a mathematical equation. The active tensions applied to the respective cables yield an actual force vector applied to the user interface tool that corresponds to the calculated force vector. The mathematical equation has at least a first term and a second term. The first term of the equation includes a net vector, which has as components a calculated force vector and the calculated tension vectors. The second term of the equation includes a function that has as arguments a respective magnitude of each of the calculated tension vectors. Further, the mathematically optimized equation is close to or equal to zero.

As discussed in the aforementioned interview of December 23, 2009, the cited references do not teach or suggest a processor system that calculates tension vectors based on a mathematical optimization of an equation. The amendments to claim 12 clarify the underlying mathematical nature of the phrase “the processor system is configured to determine the amount of active tension to be applied using an optimization process to minimize an objective function,” as previously recited in claim 67.

The claimed processor system is an aspect of previously presented claim 14, and in rejecting claim 14, the Office Action mailed October 5, 2009, admitted that Sato, Guy and Stork fail to expressly disclose a processor system that is configured to determine a force vector to be applied to a user interface tool, and to determine an amount of active tension to be applied by a motor of each tool translation effector device to produce the determined force response. Thus, Applicants submit that Sato, Guy and Stork similarly fail to teach or suggest a processor system that calculates tension vectors based on a mathematical optimization of an equation. To cure the deficiency of Sato, Guy and Stork the Office Action relied on Massie for allegedly disclosing a force reflecting haptic interface employing active tension, citing column 21, line 3 through column 22, line 2.

At column 21, line 3 through column 22, line 2, Massie discusses a control apparatus 570 that includes a kinematics analysis unit 572 and a Jacobian application unit 574. There is no discussion or suggestion in the cited portion of Massie, or in the whole of Massie, of

a processor system that calculates tension vectors based on a mathematical optimization of an equation.

The claimed processor system calculates vectors corresponding to active tensions applied to the respective cables based at least on a mathematical optimization of a mathematical equation, which is similar to aspects of claims 67 and 68. The Office Action cited Guy column 1, lines 48-53, for allegedly disclosing an optimization process.

At column 1, lines 43-53, Guy states the following:

Based on the configuration and orientation of the transmission elements, multiple independent degrees of freedom may be provided. Depending on the particular application for the interface, each degree of freedom may be either powered and/or tracked, or free, being neither powered nor tracked. For example, a degree of freedom may be powered by a motor or other actuator so that, under appropriate conditions, the interface can resist, balance, or overcome a user input force along that degree of freedom. The powered axis may be active, with force being varied as a function of system conditions, or passive, such as when a constant resistance or drag force is applied.

Applicants respectfully submit that the portion of Guy cited by the Office Action, column 1, lines 48-53, is directed to the general statement that “[b]ased on the configuration and orientation of the transmission elements, multiple independent degrees of freedom may be provided.” (Column 1, lines 43-45.) There is nothing in the cited portion of Guy, or in the whole of Guy, to teach or suggest a processor system that calculates tension vectors based on a mathematical optimization of an equation.

Consequently, Sato, Guy, Stork and Massie fail, individually and collectively, to teach or suggest a processor system that calculates tension vectors based at least on mathematically optimizing an equation, and therefore, Applicants respectfully request that the rejection of claim 12 be withdrawn.

Claims 13-15, 17, 26-28, 42, 53, 54, 67 and 68 depend, directly or indirectly, from claim 12, and consequently, are allowable for at least the reason that they depend from an allowable claim.

3. Amended Independent Claims 9, 38, 62 and 70

Independent claims 9, 38, 62 and 70 have been amended to recite language similar, but not identical, to language recited in claim 12.

Applicants respectfully submit that the allowability of claims 9, 38, 62 and 70 is readily apparent based at least on the above discussion.

For at least the reason that claims 39, 49-52, 55, 59-61, 63-65, 71, and 73 depend, directly or indirectly, from allowable claims, as described above, these claims are also allowable.

Conclusion

Applicants respectfully submit that the pending claims are in condition for allowance. Any remarks in support of patentability of one claim should not be imputed to any other claim, even if similar terminology is used. Any remarks referring to only a portion of a claim should not be understood to base patentability on that portion; rather, patentability must rest on each claim taken as a whole. A number of clarifying amendments have also been made to the above claim set. Applicants do not acquiesce to each of the Examiner's rejections and to each of the Examiner's assertions regarding what the cited references show or teach, even if not expressly discussed herein. Although changes to the claims have been made, no acquiescence or estoppel is or should be implied thereby; such amendments are made only to expedite prosecution of the present application and are without prejudice to the presentation or assertion, in the future, of claims relating to the same or similar subject matter.

If the undersigned attorney has overlooked a relevant teaching in any of the references, the Examiner is requested to point out specifically where such teaching may be found. In light of the above amendments and remarks, Applicants respectfully submit that all pending claims are allowable. Applicants, therefore, respectfully request that the Examiner reconsider this application and timely allow all pending claims. The Examiner is encouraged to

contact the undersigned by telephone to discuss the above and any other distinctions between the claims and the applied references, if desired. If the Examiner notes any informalities in the claims, the Examiner is encouraged to contact the undersigned by telephone to expediently correct such informalities.

Respectfully submitted,
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